

REMARKS

Claims 1 - 20 remain active in this application. Claim 4 has been amended to correspond to an editorial revision previously made in claim 3. Claims 1 and 16 have been amended to correspond to each other as to the terms sparse array of targets and fiducial marks. No new matter has been introduced into the application. The withdrawal of previous grounds of rejection and acceptance of the formal drawings are noted with appreciation.

Claims 1 - 4, 6 - 8 and 19 - 20 have been rejected under 35 U.S.C. §103 as being unpatentable over Aizaki in view of Utsumi; claims 5, 11 - 13 and 16 - 18 have been rejected under 35 U.S.C. §103 as being unpatentable over Aizaki in view of Utsumi and Goodberlet et al.; claims 9 - 10 have been rejected under 35 U.S.C. §103 as being unpatentable over Aizaki in view of Utsumi and Sakamoto et al.; and claims 14 - 15 have been rejected under 35 U.S.C. §103 as being unpatentable over Aizaki in view of Utsumi, Goodberlet et al. and Sakamoto et al. All of these grounds of rejection are respectfully traversed since, of the applied references, only Goodberlet has anything at all to do with the invention and, as pointed out in the citation thereof on page 5 of the present specification, Goodberlet operates in a manner directly contrary to the invention, as claimed, by which the meritorious effects of the invention are achieved.

Specifically the invention provides extremely high beam positional accuracy even in regard to broad and patterned beams and without substantial beam current or current density reduction of causing non-uniformity of illumination by developing a "shadow pattern", dithering that shadow pattern and detecting when the shadow pattern is incident on a sparse array of targets or fiducial marks, as recited in both independent

claims 1 and 16. By doing so, every points of every edge of the shadow pattern effectively becomes a probe for detection of beam position, as explicitly stated at page 13, lines 1 - 9, allowing correction of beam position to a high degree of accuracy and without ambiguity even across a broad and patterned beam. This technique is quite literally contrasted with Goodberlet et al. which does not form a shadow pattern within the beam and thus does not dither or detect the shadow pattern but, rather, detects the incidence of the *beam*, itself, on a fiducial mark and thus not only relies on the narrowness of the beam (which limits accuracy) but cannot be applied to a broad beam, as discussed in the above-noted passage of page 13 and the following text. Further, in accordance with the invention, the shadow pattern can be made very narrow, both in the lithographic formation of the mesh 110 and through demagnification, to further increase accuracy independently of beam diameter. By the same token, reduction of beam current intercepted by the probe mesh 110 can be minimized and held to 10% to 15% or less while the dithering of the shadow pattern does not adversely affect the uniformity of illumination at the target. Therefore, in summary, the invention, as claimed operates precisely contrary to Goodberlet et al. in a manner which supports the meritorious effects of the invention which are not taught or suggested, much less realized, in Goodberlet et al.

The remainder of the prior art applied by the Examiner has nothing at all to do with detection and correction of beam position. In Aizaki, the system which is discussed as "known" provides a third aperture mask with a plurality of meshed apertures having different transmissivities in order to intercept different portions of the beam current (column 3, lines 57 -64). However, as can be seen from Figure 2 and as must necessarily be the case to avoid irregularities in

beam current density, this third aperture mask is placed where the beam is defocused and thus does not develop a shadow pattern. Therefore, Aizaki does not detect a shadow pattern which is not produced.

(Element 50 is the target wafer and does not produce or detect a shadow pattern in the beam and certainly not for position detection.) The improvement thereover provided by Aizaki uses a lens 12a, 12b to alter the spread of the beam above aperture plate 13a to allow the beam current to be varied more rapidly and precisely responsive to sampling beam current with a Faraday cup 18 which does not detect or only coarsely beam position. Utsumi is directed to an electron beam tool for use with very thin, ultra-high sensitivity resists such that beam current can be greatly reduced to limit proximity and Coulomb effects on the beam. Mask 30 is preferably a stencil mask (column 5, lines 47 - 67) and no detection function, particularly of the position of a shadow, is seen to be disclosed for it. (Incidentally, "dithering", while similar to scanning in some respects, is apparently confused with scanning by the Examiner: scanning, particularly in a raster, deflects a beam over an area to perform a principal function of the device such as display or exposure while dithering is basically the movement of a beam by a small dimension in a repeated pattern about a given position of the beam.) Aperture plate 16 is a beam limiting aperture (column 4, line 43) and does not develop a shadow pattern in the beam. Similarly, Sakamoto et al. is directed to a shaped beam system but no shadow pattern within the beam or detection of the shadow pattern at a sparse array of targets or fiducial marks is seen and the Examiner does not suggest reliance on Sakamoto et al. for such a teaching.

Moreover, the Examiner, in the statements of the various grounds of rejection while pointing out disclosed structure relevant to functions such as beam

shaping does not appear to mention any structure or method steps disclosed in the respective references which provides either a shadow pattern, dithering thereof or detection of incidence on a sparse array of targets or fiducial marks in any of the references and only mentions fiducial marks in connection with Goodberlet et al. (applied only to claims 5, 6 -8 and 11 - 18) but not their function (e.g. detection of the beam but not a shadow pattern). That is, the only reference in the statements of the various rejections to a shadow pattern and dithering or detection thereof appears to be incomplete with reference to the actual claim recitations and erroneous conclusions as to the content of Aizaki which can only be reached through impermissible hindsight. Therefore, it is respectfully submitted that the Examiner has not made a *prima facie* demonstration of obviousness as to any claim in the application and has effectively ignored explicit recitations of the claims if not substantially the entire subject matter thereof.

Accordingly, it is respectfully submitted that the conclusions of obviousness which the Examiner has asserted are not supported by the references relied upon. The references other than Goodberlet et al. are completely irrelevant to beam position detection and correction and the distinctions from Goodberlet et al. are discussed in the application as originally filed as well as in the responses to the official actions. None of the references teach or suggest the claimed subject matter or can provide evidence of the level of ordinary skill in the art which would support the Examiner's conclusions of obviousness because they do not, singly or collectively, lead to an expectation of success in achieving the meritorious effects of the invention, particularly by producing, dithering and detecting a shadow pattern in the beam. Therefore, it is respectfully submitted that the asserted grounds of

rejection are in error and untenable and reconsideration and withdrawal thereof is respectfully requested.

Since all rejections, objections and requirements contained in the outstanding official action have been fully answered and shown to be in error and/or inapplicable to the present claims, it is respectfully submitted that reconsideration is now in order under the provisions of 37 C.F.R. §1.111(b) and such reconsideration is respectfully requested. Upon reconsideration, it is also respectfully submitted that this application is in condition for allowance and such action is therefore respectfully requested.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Deposit Account No. 09-0458 of International Business Machines Corporation (E. Fishkill).

Respectfully submitted,



Marshall M. Curtis
Reg. No. 33,138

Whitham, Curtis & Christofferson, P. C.
11491 Sunset Hills Road, Suite 340
Reston, Virginia 20190

(703) 787-9400



30743

PATENT TRADEMARK OFFICE